TCP/IP Security Attacks

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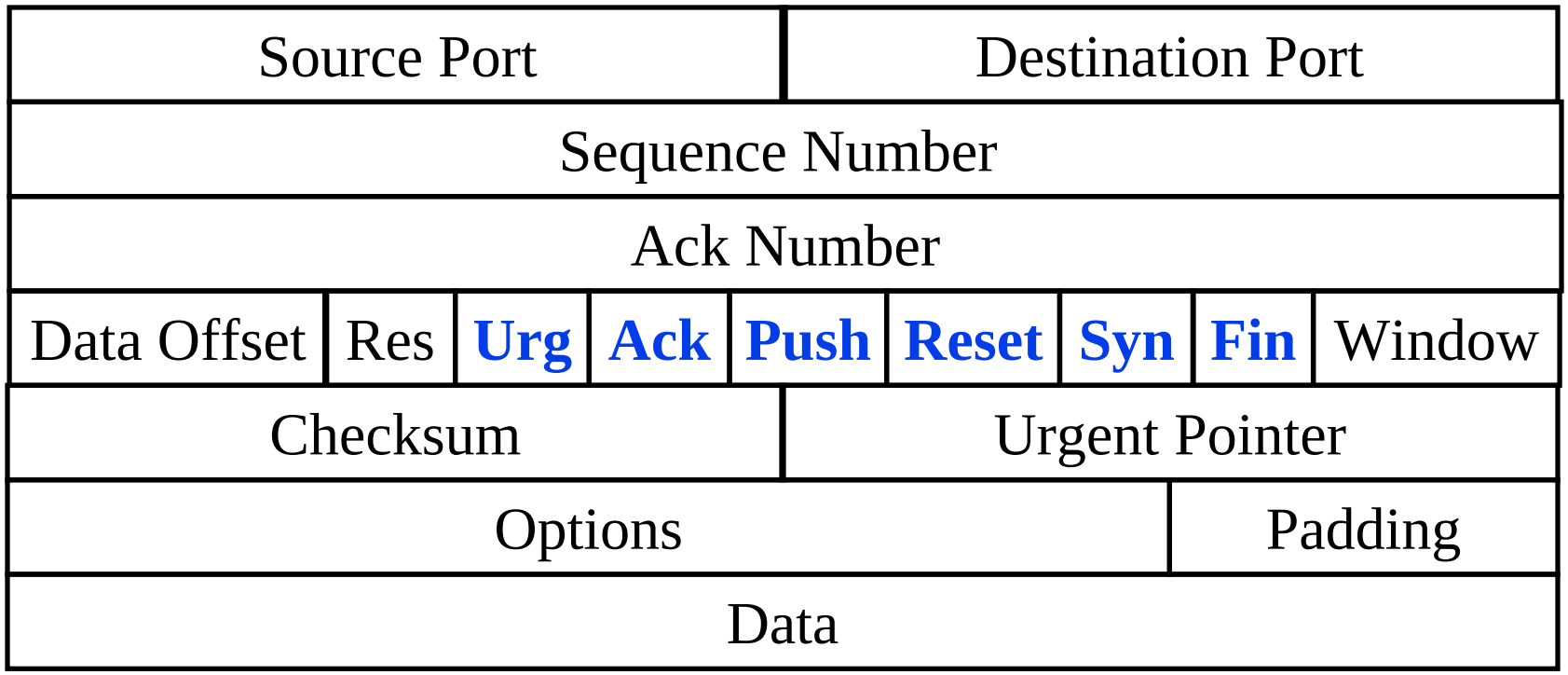
These slides are available on-line at:

http://www.cse.wustl.edu/~jain/cse571-09/

Overview

1. TCP Segment Format, Connection Setup, Disconnect
2. IP: Address Spoofing, Covert Channel, Fragment Attacks, ARP, DNS
3. TCP Flags: Syn Flood, Ping of Death, Smurf, Fin
4. UDP Flood Attack
5. Connection Hijacking
6. Application: E-Mail, Web spoofing

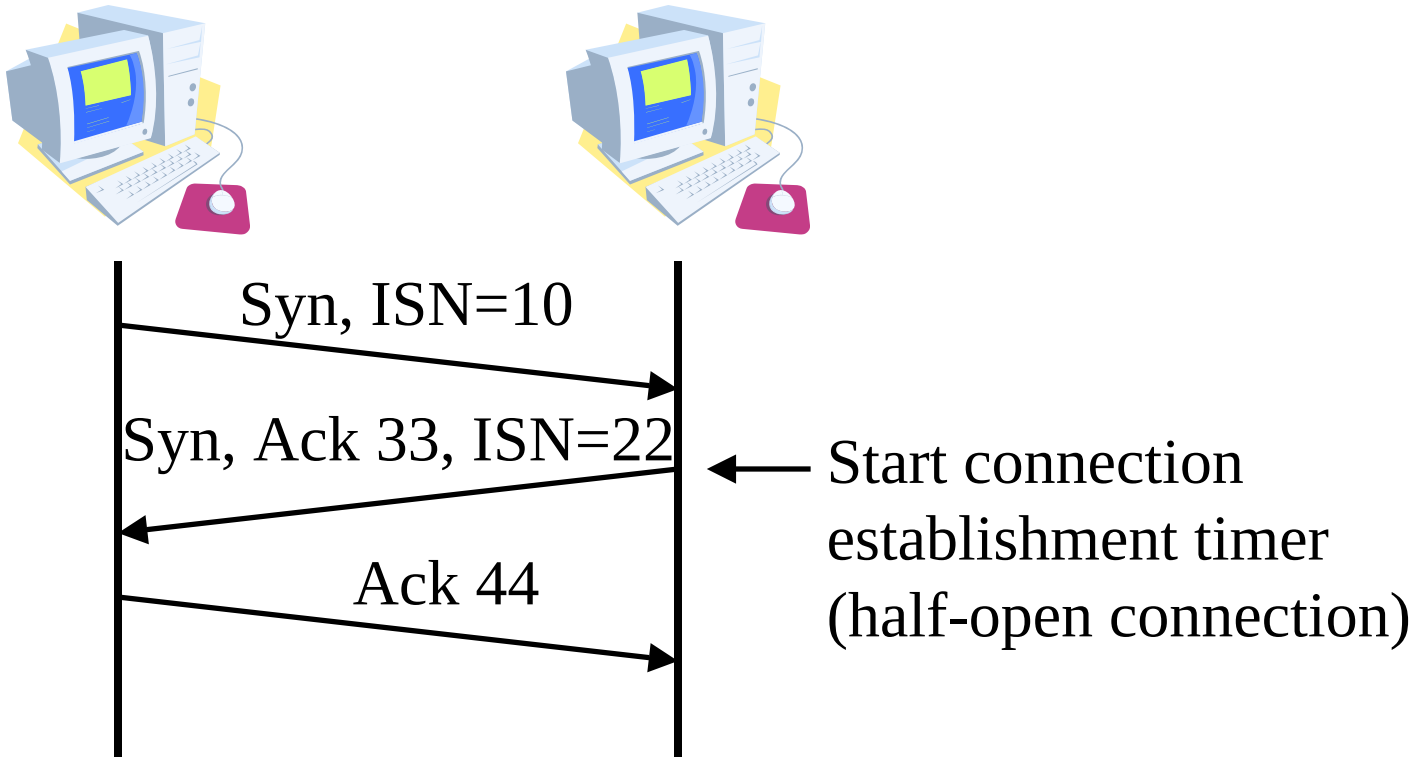
TCP Segment Format



- Urgent: Deliver immediately at destination
- Push: Leave source immediately
- First data byte is ISN+1. Ack is next byte expected. Expecting Ack to Ack+window-1 next.

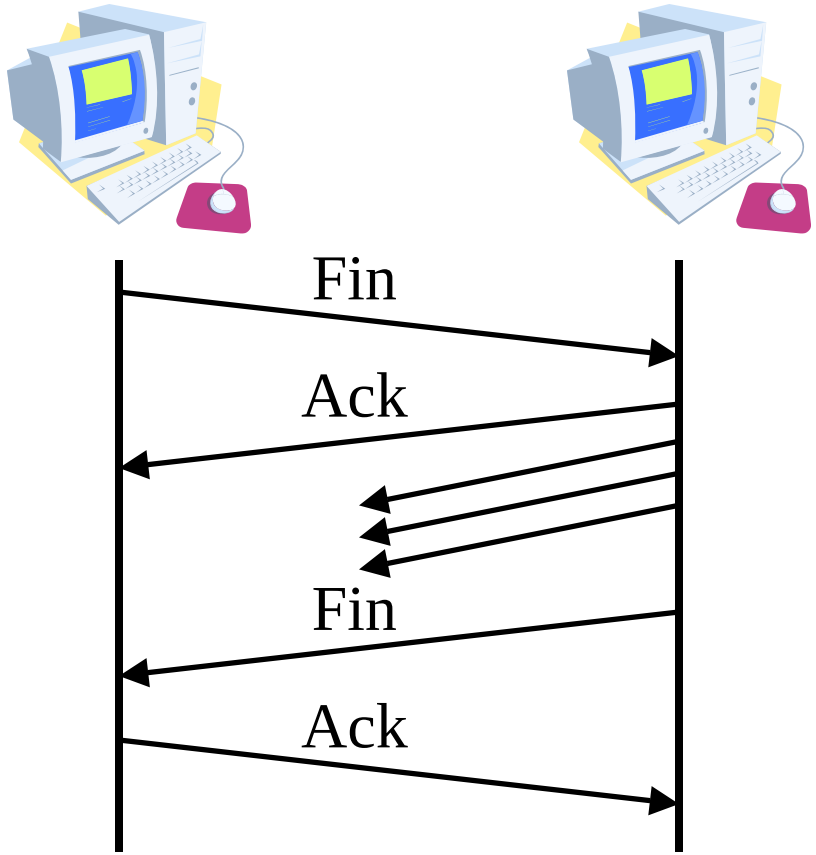
TCP Connection Setup

- Three way handshake



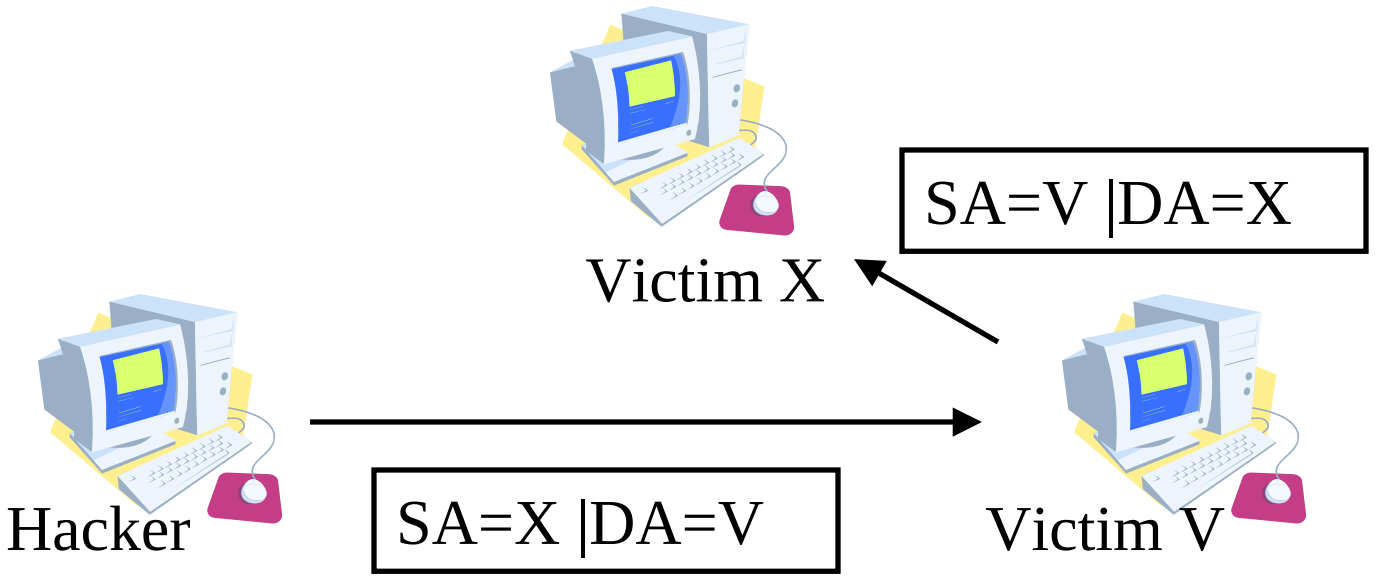
TCP Disconnection

- Fin ⇒ No more data. Connection can be closed.
- Four-way handshake



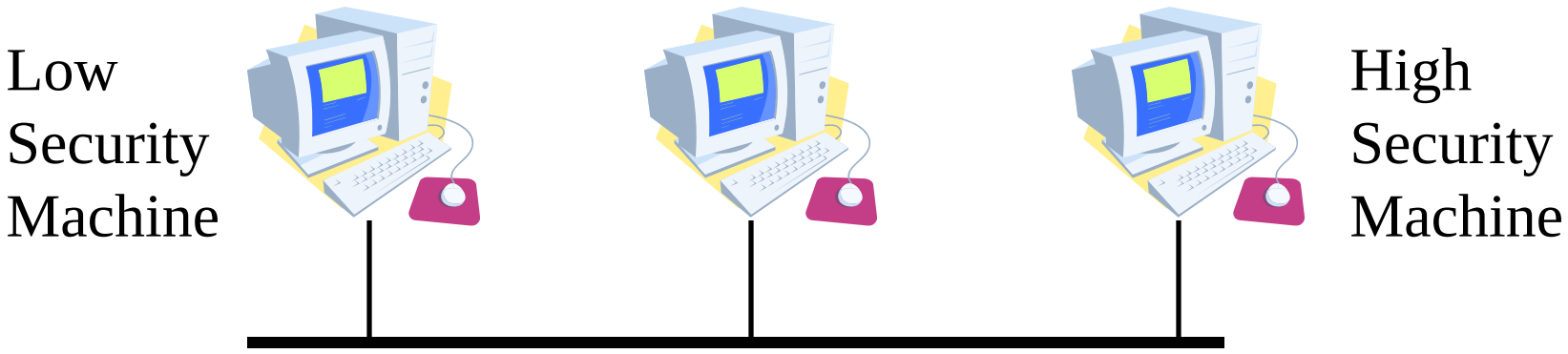
IP Address Spoofing

- Send requests to server with someone X's IP address. The response is received at X and discarded. Both X and server can be kept busy ⇒ DoS attack



Covert Channel

- **Loki** - a client server application,
  - Uses ICMP echo to send covert commands
  - http://xforce.iss.net/xforce/xfdb/1452
- **Timing Channel** - CPU load indicates a 0 or 1 (Two processes on the same machine)
- **Storage Channel** - Print queue length large = 1, small=0



IP Fragment Attacks

- Fragments can overlap
- Final packets can be too large

TCP Flags

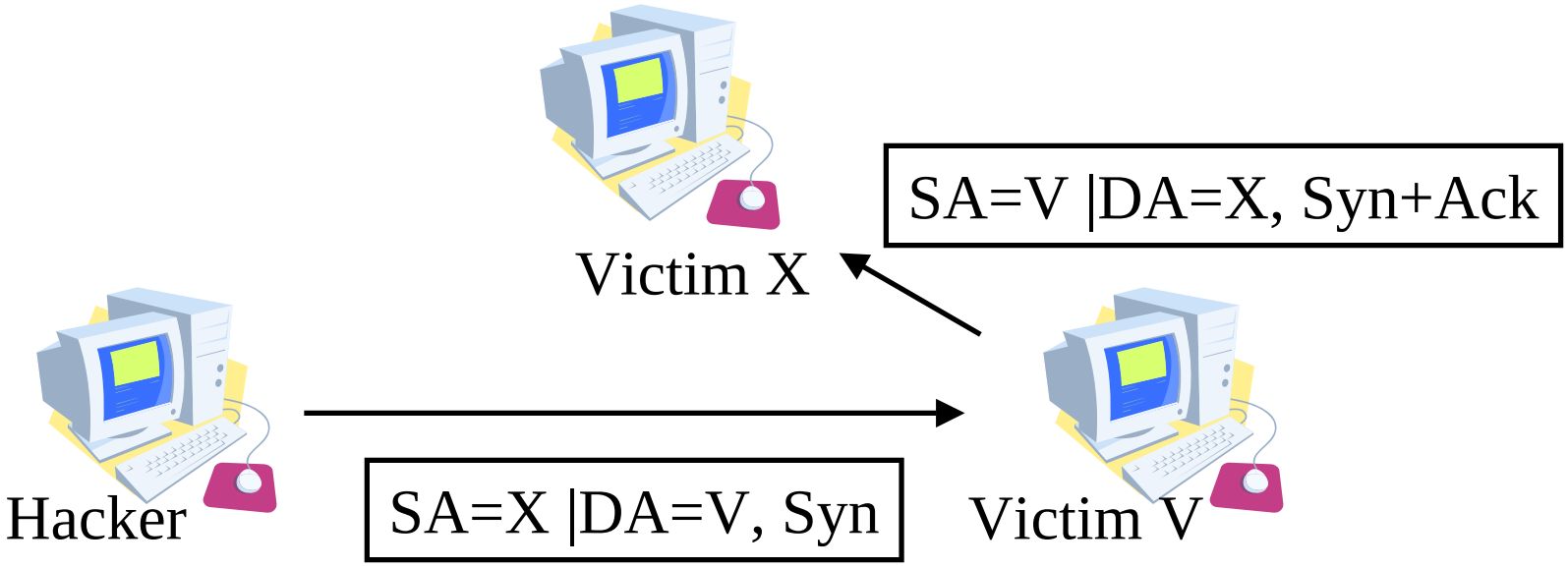
- Invalid Combinations

Syn	Fin	Psh	Rst
1	1	0	0
1	1	1	0
1	1	0	1
1	1	1	1

- May cause recipient to crash or hang

Syn Flood

- A sends Syn request with IP address of X to Server V.
- V sends a syn+ack to X
- X discards syn+ack leaving an half open connection at V.
- Many open connections exhausts resources at V $\Rightarrow$ DoS



Ping of Death

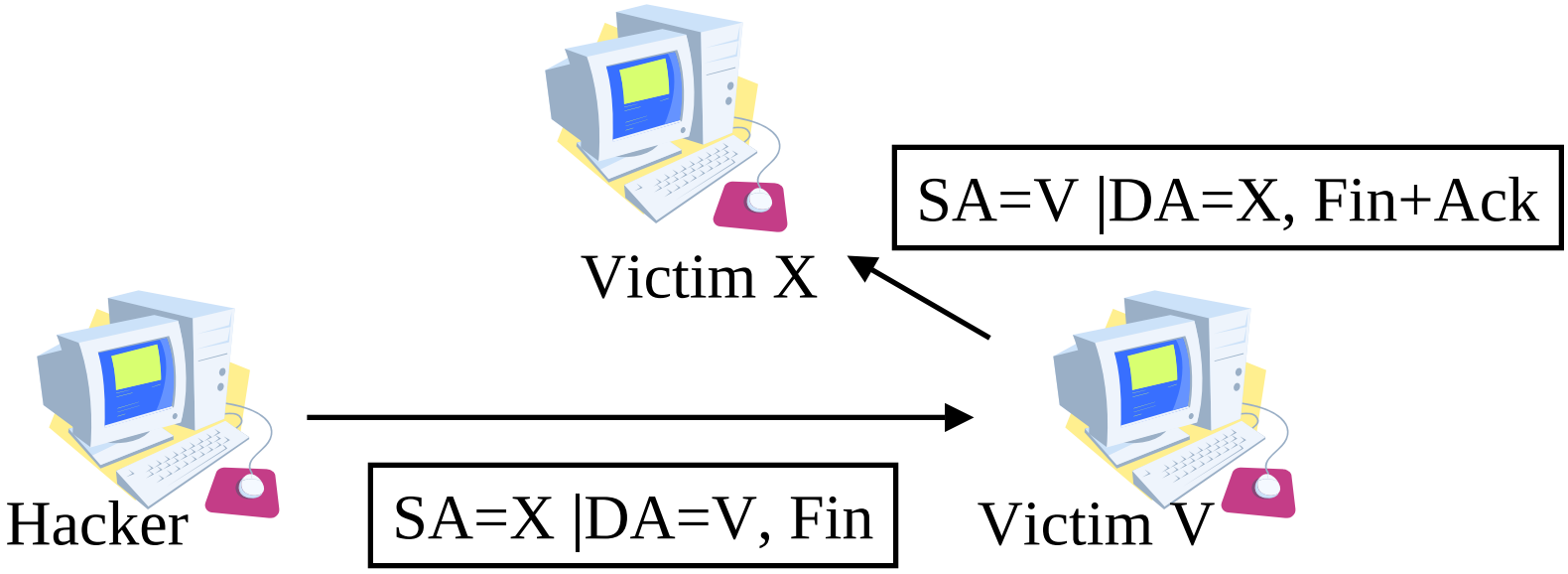
- Send a ping with more than 64kB in the data field.
- Most systems would crash, hang or reboot.

Smurf

- Send a broadcast echo request with the V's source address.
- All the echo replies will make V very busy.

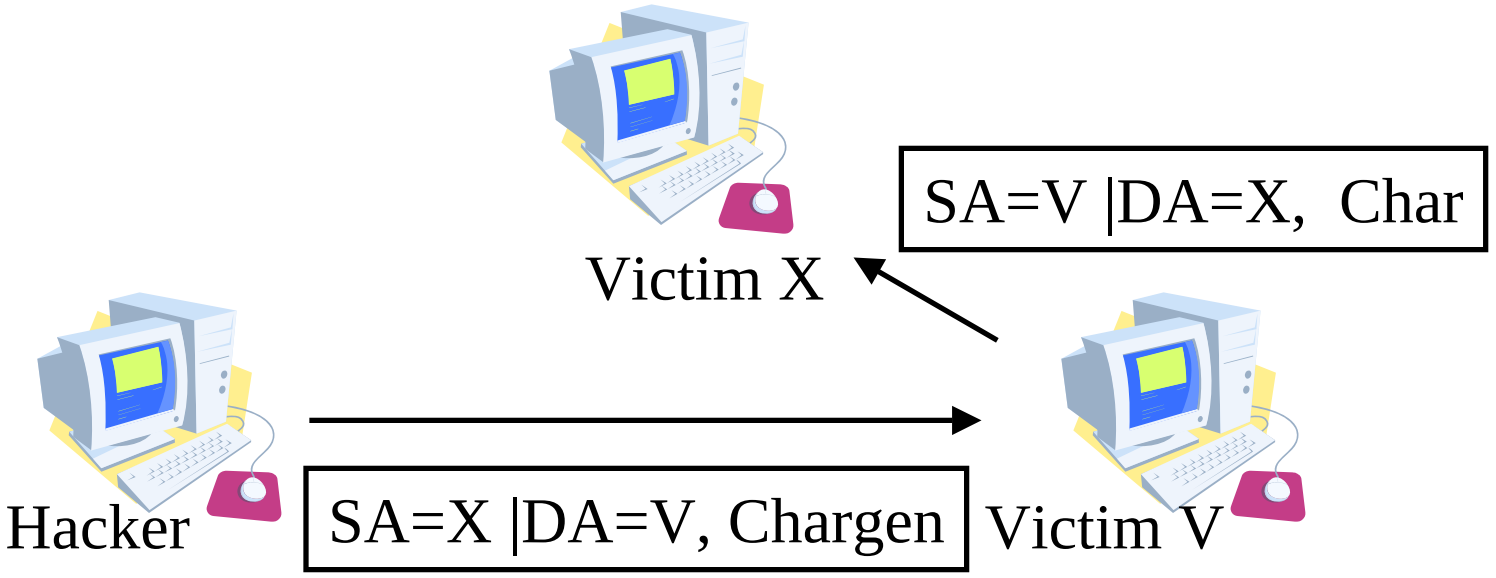
Fin

- In the middle of conversation between X and V.
- H sends a packet with Fin flag to V.
- V closes the connection and disregards all further packets from X.
- RST flag can be used similarly



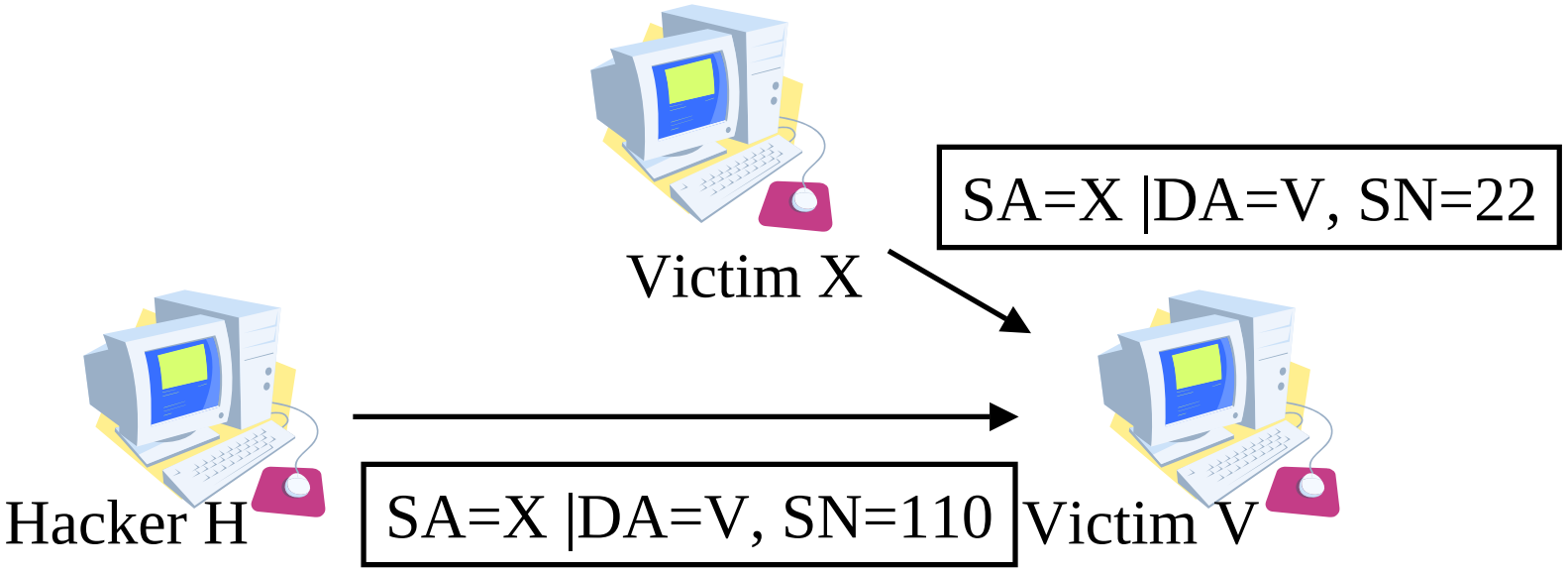
UDP Flood Attack

- Character Generator (Chargen) request results in a response with random characters being returned.
- Used to diagnose lost packets on the path between two hosts.
- Uses TCP/UDP port 19.
- H can send a chargen request from X to V.
- V can respond to X wasting their bandwidth.



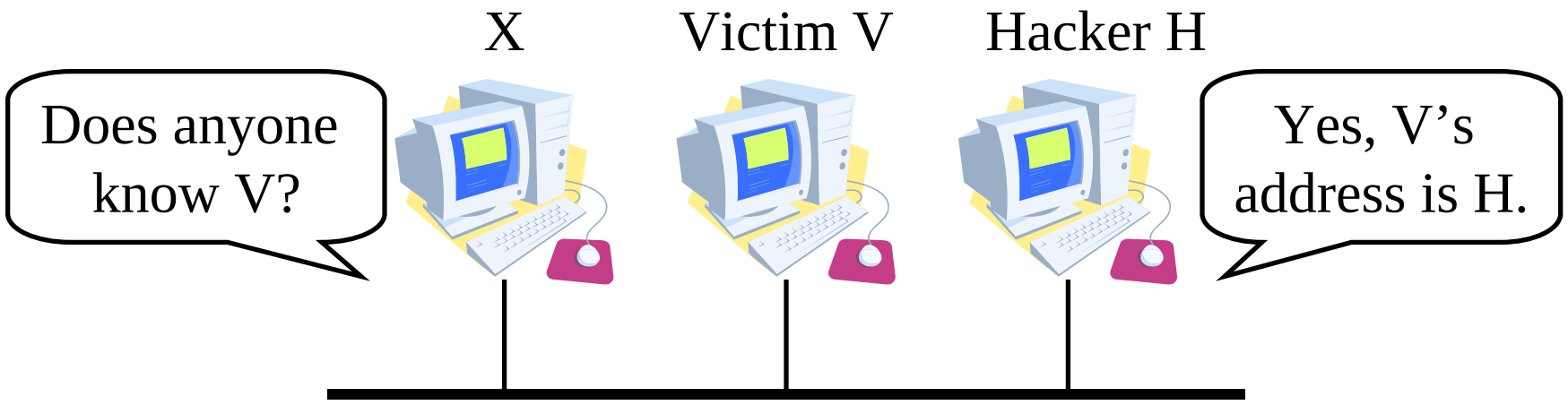
Connection Hijacking

- H sends packets to server V which increments the sequence number for connection from X.
- All further packets from X are discarded at V.
- Responses for packets from H are sent to V - confusing him.



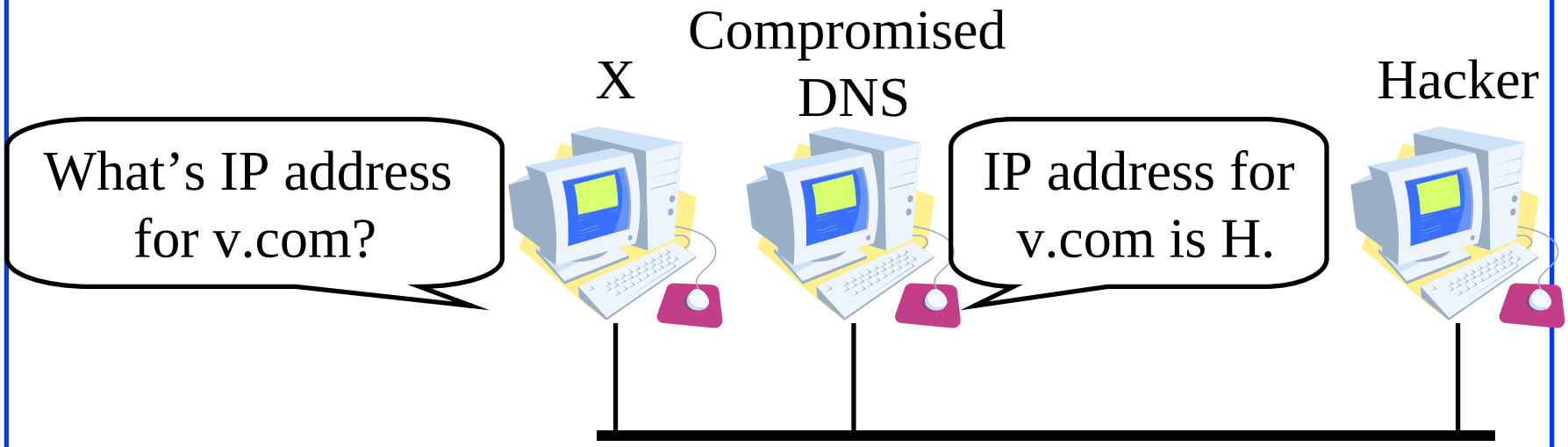
ARP Spoofing

- X tries to find the MAC address of Victim V
- Hacker H responds to ARP request pretending to be V.
- All communication for V is captured by H.
- Hacker may flood fraudulent ARP requests and replies
- Countermeasure: Use static ARP



DNS Spoofing

- DNS server is compromised to provide H's IP address for V
- Virus can modify hosts files
- Access router modified to point to poisoned DNS ⇒ Pharming
- Phishing: security patch from www.microsoft.com.128.252.160.33/download
- DNS zone transfer ⇒ Ask DNS for all domain names and addresses ⇒ Allows attackers to footprint



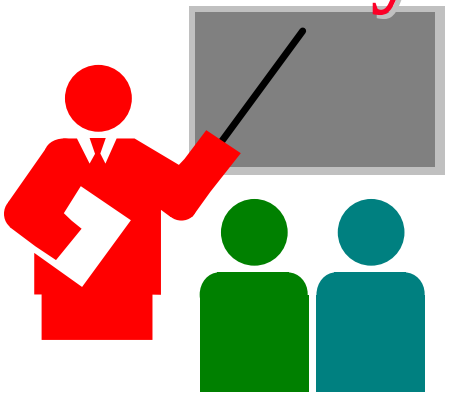
E-Mail Spoofing

- From address is spoofed.
- Malware attachment comes from a friendly address.
- From: God@heavens.com

Web Spoofing

- The web site looks like another
- Southwest Airline, http://airlines.ws/southwest-airline.htm
- For every .gov site there is a .com, .net giving similar information: nsf.com, tsa.com, whitehouse.com
- For misspellings of popular businesses, there are web sites: microshoft.com

Summary



1. TCP port numbers, Sequence numbers, ack, flags
2. IP addresses are easy to spoof.
   ARP and DNS are not secure.
3. Flags: Syn Flood, Fin
4. Ping of Death, Smurf, Connection Hijacking
5. UDP Flood Attack
6. Application addresses are not secure

References

1. Jan L. Harrington, "Network Security," Morgan Kaufmann, 2005, ISBN:0123116333
2. Gert De Laet and Gert Schauwers, "Network Security Fundamentals," Cisco Press, 2005, ISBN:1587051672

Lab Homework 3

- This lab consists of using the following tools:
- XP Keylogger, http://www.bestvistadownloads.com/download/t-free-xp-keylogger-download-zhtdqdgn.html
- SMBdie: A tool to crash windows server described at http://www.windowsecurity.com/articles/SMBDie_Crashing_Windows_Servers_with_Ease.html download from http://packetstormsecurity.org/0208-exploits/SMBdie.zip
- Snort, vulnerability scanner, http://www.codecraft-canada.com/Snort/
- Password dump, Pwdump3, http://www.openwall.com/passwords/dl/pwdump/pwdump3v2.zip
- John the ripper, Brute force password attack, http://www.openwall.com/john/

Lab Homework 3 (Cont)

- If you have two computers, you can install these programs on one computer and conduct these exercises.
- Alternately, you can remote desktop to CSE571XPC and conduct exercises 1-4 and then remote desktop to CSE571XPS and conduct exercise 5.
- Use your last name (with spaces removed) as your user name.

1. Keylogger

- Delete all previous log files, if any, e:\program files\xp keylogger\logs*.*
- Start xp keylogger
- Browse to www.google.com and search for your name
- Stop keylogger
- CD to e:\program files\xp keylogger\logs\
- Open the htm file in the browser
- Note down the texts shown there on a paper and submit.
- Delete the log e:\program files\xp keylogger\logs*.*

2. Snort

- Delete all the previous logs, if any, e:\snort\log\new*.*
- Start snort
- Go back to your machine
- Run smbdie to attack CSE571XPC
- When the program stops, connect back to CSE571XPC
- Use control-C to stop snort
- Type the log file e:\snort\log\new\alert.ids
- Count how many time smbdie is mentioned.
- Delete the logs, e:\snort\log\new*.*

3. PWDump3

- Goal: Get the password hash from the server CSE571XPS
- On CSE571XPC, open a dos box
- CD to e:\pwdump3
- Run pwdump3 without parameters for help
- Run pwdump3 with parameters to get the hash file from server CSE571XPS
- You will need the administrator account and password supplied in the class.
- Open the hash file obtained in notepad. Delete all lines except the one with your last name.
- Save the file as e:\johntheripper\<your_last_name>.txt

4. Find your password

- On CSE571XPC, use the command box
- CD to e:\johntheripper
- Delete john.pot
- Run johntheripper without parameters to get help
- Run johntheripper with the file you created in step 3
- This will tell you your password, write it down on a paper to submit with the homework.
- Close your remote desktop session.

5. Change your password

- Now remote desktop to CSE571XPS
- Login using your last name as username and the password you obtained in step 4.
- Change your password to a strong password.
  Do this from your own account (not the administrator account).
- Note the time and date you change the password.
  Submit the time as homework answer.
- Logout